Nanoleader™ Pump Series

NLS110P Pressure Pump

User's Manual

NLS110P Pressure Pump *MA1 70-5000*

HARVARD APPARATUS

Publication 5422-001-REV-A

WEEE/RoHS Compliance Statement

EU Directives WEEE and RoHS

To Our Valued Customers:

We are committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for our products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive – Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of our products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. We will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.

- **Do Not Dispose Product with Municipal Waste**
- **Special Collection/Disposal Required**

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Serial Numbers

All inquires concerning our product should refer to the serial number of the unit. Serial numbers are located on the rear of the chassis.

Calibrations

All electrical apparatus is calibrated at rated voltage and frequency. While the flow will stay calibrated, the peak will vary.

Warranty

Harvard Apparatus warranties this instrument for a period of two years from date of purchase. At its option, Harvard Apparatus will repair or replace the unit if it is found to be defective as to workmanship or material.

This warranty does not extend to damage resulting from misuse, neglect or abuse, normal wear and tear, or accident.

This warranty extends only to the original customer purchaser.

IN NO EVENT SHALL HARVARD APPARATUS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE.** Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the two-year warranty period, promptly contact ***Harvard Apparatus, Inc. 84 October Hill Road, Holliston, Massachusetts 01746-1371*** using our toll free number 1-800-272-2775. Goods will not be accepted for return unless an RMA (returned materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs, replacement and return. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.

Repair Facilities and Parts

Harvard Apparatus stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using our part numbers. If practical, enclose a sample or drawing. We offer a complete reconditioning service.

CAUTION

This pump is not registered with the FDA and is not for clinical use on human patients.

CAUTION
NOT FOR CLINICAL USE
ON HUMAN PATIENTS

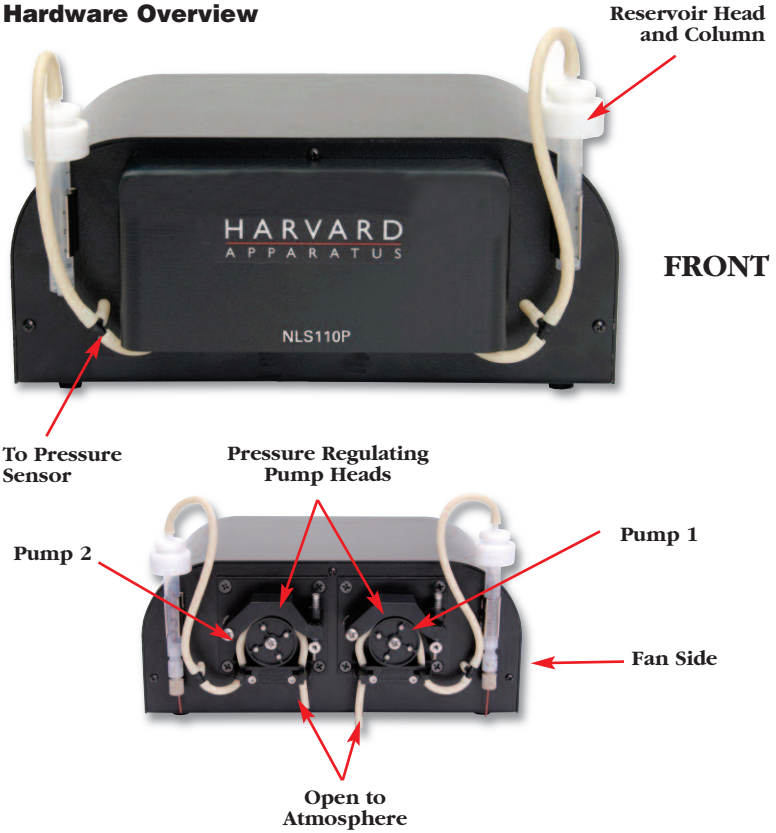
Specifications

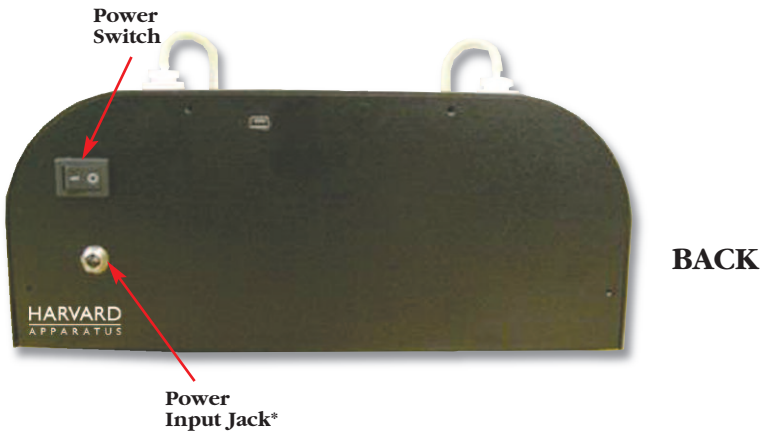
Specifications	
Accuracy	+/- 0.05 psi
Reproducibility	+/- 0.1% over the operating range
Resolution	+/- 0.01 psi
Type	Dual channel pressure pump
Pressure	+15 psi to -15 psi
Flow Rate	Calibrated from experimental data
Reservoir Column	Variable; comes standard with 1cc
Serial Port	USB
Outputs	Time (ms) and psi
Power	24Vdc, 1.7A, 40W
Voltage Range	Universal Power Supply, 100-240 VAC, 50/60 Hz
Dimensions	24.13 x 17.78 x 10.16 cm (9.5 x 7.0 x 4.0 in)
Weight	15.91 kg (7.23 lb)

Introduction

The Nanoleader™ Pump Series NLS110P Pressure Pump is a revolutionary new approach to achieving a new level of pulseless, precise and accurate low flow utilizing constant pressure technology. This new approach results in virtually pulseless flows making experimentation like bubble formation or reproducible flows in multi-channels possible. This patented pressure monitoring system assures you the highest quality, low flow characteristics. This pump is an easy to use computer controlled dual-channel non-pulsatile pressure pump. It has two independent channels of flow with the option of two more independent channels available on the PC software. The NLS110P Pressure Pump comes standard with PC software and a 1 cc reservoir column.

Hardware Overview





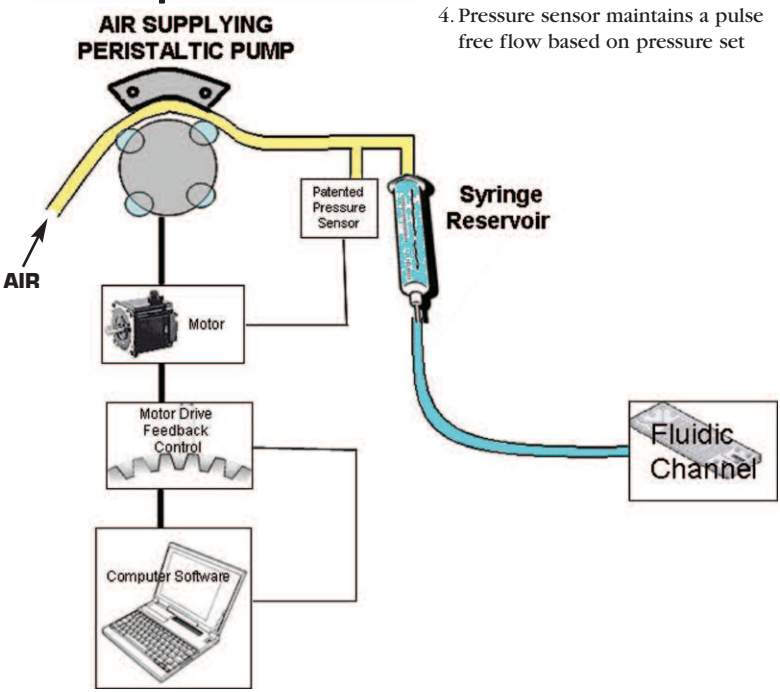
** Power Supply Input: 100-240 Vac, 50/60 HZ*
Power Supply Input: 24 Vdc, 1.7A, 40W

NLS110P - How it Works

High Performance, Low Flow Pressure Control Flow System, Harvard Apparatus NLS110P

NLS110P - How It Works:

1. Pump generates a pressurizing flow of air
2. Pulse of air is compressible and dampened
3. Liquid reservoir is pressurized
4. Pressure sensor maintains a pulse free flow based on pressure set



Power Attachment

Using the provided line cord and power supply, attach the instrument to 110 VAC or 220 VAC.

Tubing Connections

Install tubing as shown in Figure 1. Leave one side open and attach the output port to the provided liquid reservoir or to the input of the system to be controlled.

What's Included

The pump comes standard with 10 feet of 1/16" OD tubing, 10 feet of 1/32" OD tubing, fittings and ferrules.

Do's and Dont's

DO: Begin with a slightly positive pressure target when connecting to an external fluid reservoir without a filter, to ensure that liquid is not sucked into the sensor.

DO: Press the "STOP" button in the application before closing the application, turning off power to the pump, or unplugging the USB cable.

DON'T: **Allow liquid to enter the pressure sensor. This will permanently damage it.**

DON'T: Turn on/off any power while the air reservoir is sealed. Always leave it open to air, as the pump may spike and overload the sensor.

DON'T: Attempt to apply or measure any pressures outside of +/-15psi.

DON'T: Seal the other side of the peristaltic pump tubing.

If the system is working properly…
If connected to a sealed air reservoir, the pump should not continue to spin. The pump should reach its target pressure within seconds.

Troubleshooting

PROBLEM: *The pump will not stop spinning when set to a non-zero target pressure.*

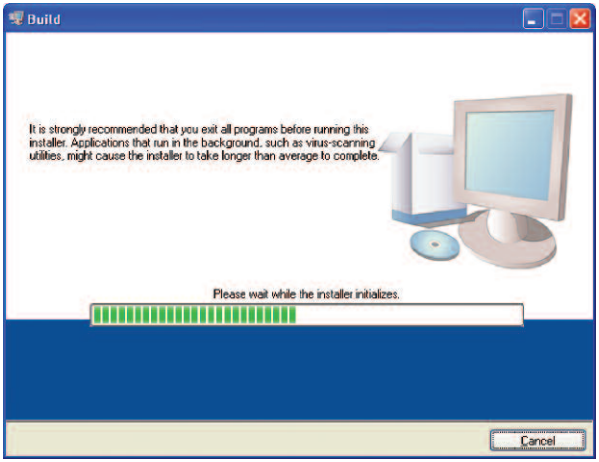
- There is a leak in the air pressure chamber.
- Tighten your connectors, and/or tighten the clamp arm of the peristaltic pump.

PROBLEM: *The MEASURED output is abnormal, even when all tubes are disconnected.*

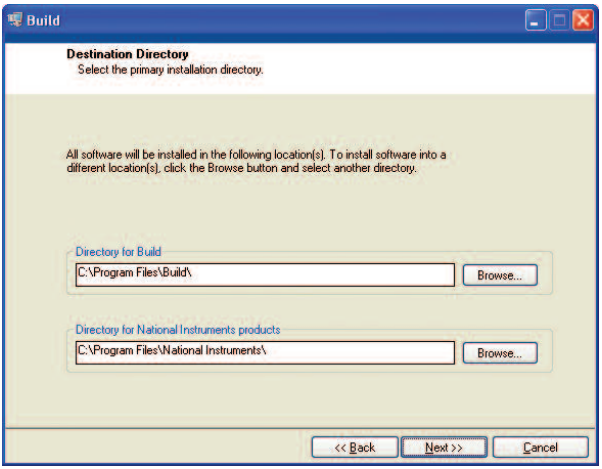
- It is likely that liquid has entered the sensor and damaged it,
- There may be something else seriously wrong with the circuit board.

PC Install Instructions

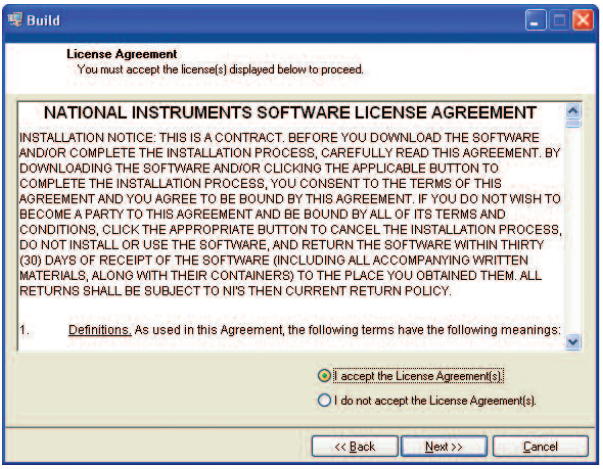
1. Insert CD to CD/DVD drive
2. The CD content should show on the display or you can run it manually by clicking on **my computer** then navigate the CD drive usually drive D.
3. Run the application from the CD or copy the content to your PC.
4. Double Click to open the folder and then open:
   NLS110P - Customer Installation > Builds > Build > My Installer > Volume > Run Setup.exe
5. The following screen will appear:


Build
It is strongly recommended that you exit all programs before running this installer. Applications that run in the background, such as virus-scanning utilities, might cause the installer to take longer than average to complete.
Please wait while the installer initializes.
Cancel

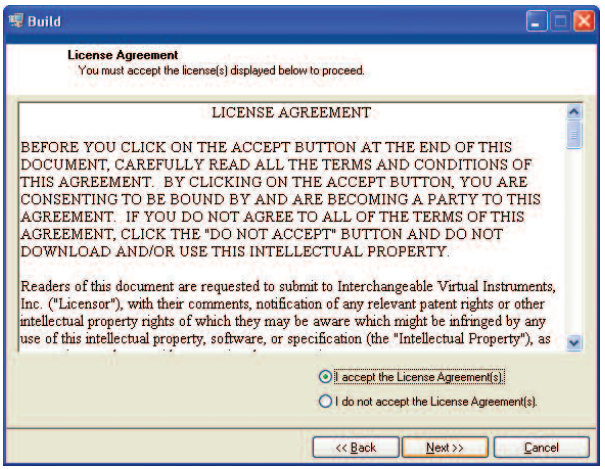
6. Select destination directory, then click next


Build
Destination Directory
Select the primary installation directory.
All software will be installed in the following location(s). To install software into a different location(s), click the Browse button and select another directory.
Directory for Build
C:\Program Files\Build\
Browse...
Directory for National Instruments products
C:\Program Files\National Instruments\
Browse...
<< Back
Next >>
Cancel

7. Choose accept, then click next


Build
License Agreement
You must accept the license(s) displayed below to proceed.
NATIONAL INSTRUMENTS SOFTWARE LICENSE AGREEMENT
INSTALLATION NOTICE: THIS IS A CONTRACT. BEFORE YOU DOWNLOAD THE SOFTWARE AND/OR COMPLETE THE INSTALLATION PROCESS, CAREFULLY READ THIS AGREEMENT. BY DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUTTON TO COMPLETE THE INSTALLATION PROCESS, YOU CONSENT TO THE TERMS OF THIS AGREEMENT AND YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT AND BE BOUND BY ALL OF ITS TERMS AND CONDITIONS, CLICK THE APPROPRIATE BUTTON TO CANCEL THE INSTALLATION PROCESS, DO NOT INSTALL OR USE THE SOFTWARE, AND RETURN THE SOFTWARE WITHIN THIRTY (30) DAYS OF RECEIPT OF THE SOFTWARE (INCLUDING ALL ACCOMPANYING WRITTEN MATERIALS, ALONG WITH THEIR CONTAINERS) TO THE PLACE YOU OBTAINED THEM. ALL RETURNS SHALL BE SUBJECT TO NI'S THEN CURRENT RETURN POLICY.
1. Definitions. As used in this Agreement, the following terms have the following meanings:
I accept the License Agreement(s).
I do not accept the License Agreement(s).
<< Back
Next >>
Cancel

8. Choose accept, then click next


Build
License Agreement
You must accept the license(s) displayed below to proceed.
LICENSE AGREEMENT
BEFORE YOU CLICK ON THE ACCEPT BUTTON AT THE END OF THIS DOCUMENT, CAREFULLY READ ALL THE TERMS AND CONDITIONS OF THIS AGREEMENT. BY CLICKING ON THE ACCEPT BUTTON, YOU ARE CONSENTING TO BE BOUND BY AND ARE BECOMING A PARTY TO THIS AGREEMENT. IF YOU DO NOT AGREE TO ALL OF THE TERMS OF THIS AGREEMENT, CLICK THE "DO NOT ACCEPT" BUTTON AND DO NOT DOWNLOAD AND/OR USE THIS INTELLECTUAL PROPERTY.
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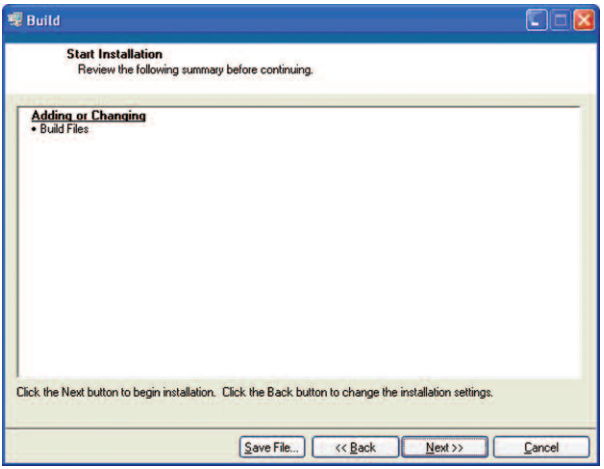
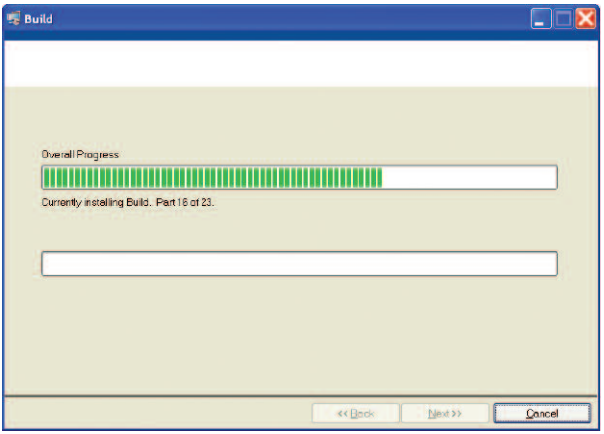
I accept the License Agreement(s).
I do not accept the License Agreement(s).
<< Back
Next >>
Cancel

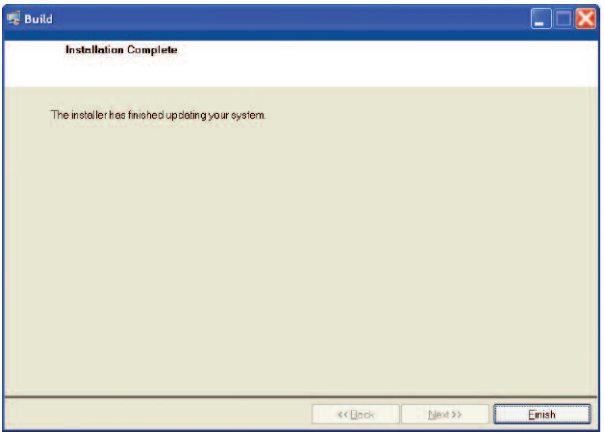
9. Start Installation by clicking next



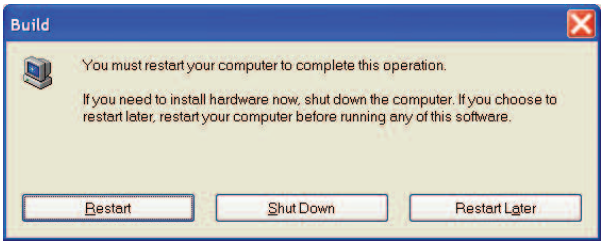
10. All necessary files will be installed
11. Wait for the installer to finish building



12. After the installer has finished building, click finish



13. After installing it will ask you to restart the PC (restart)


Build
You must restart your computer to complete this operation.
If you need to install hardware now, shut down the computer. If you choose to restart later, restart your computer before running any of this software.
Restart
Shut Down
Restart Later

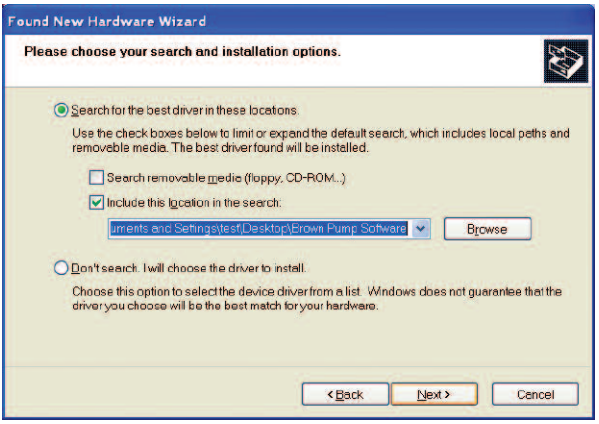
14. After the machine restarts, shut the pump off
15. Connect the USB cable as follows: mini B terminal to the back of the pump and the A terminal to the USB terminal on the PC
16. Connect the power adaptor to the DC input jack on the back of the pump
17. Turn on the power switch on the back of the pump
18. The PC should recognize that there is a new hardware installed
19. Select yes, this time only then click next

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

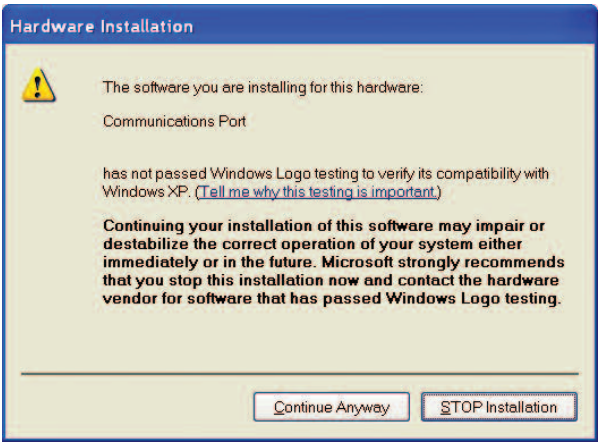
20. Select install from a list or a specific location then click next

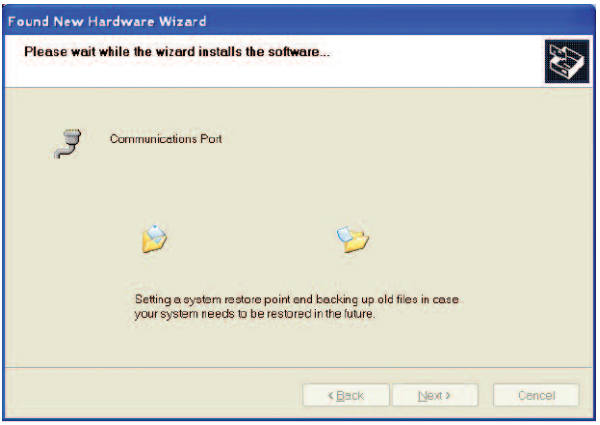
Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

21. Browse to the main folder that was copied from the CD or browse the CD then click next

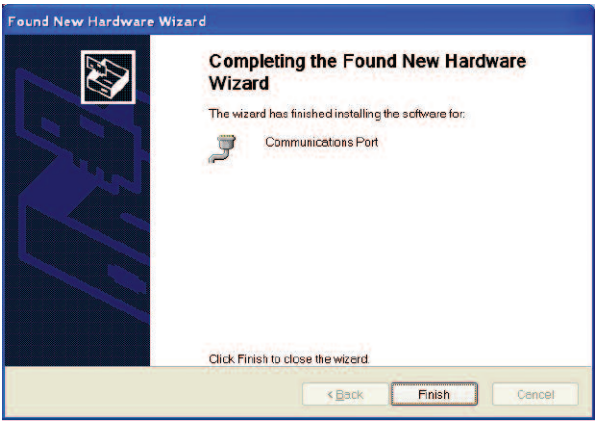

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

22. Click continue anyway


Hardware Installation
The software you are installing for this hardware:
Communications Port
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

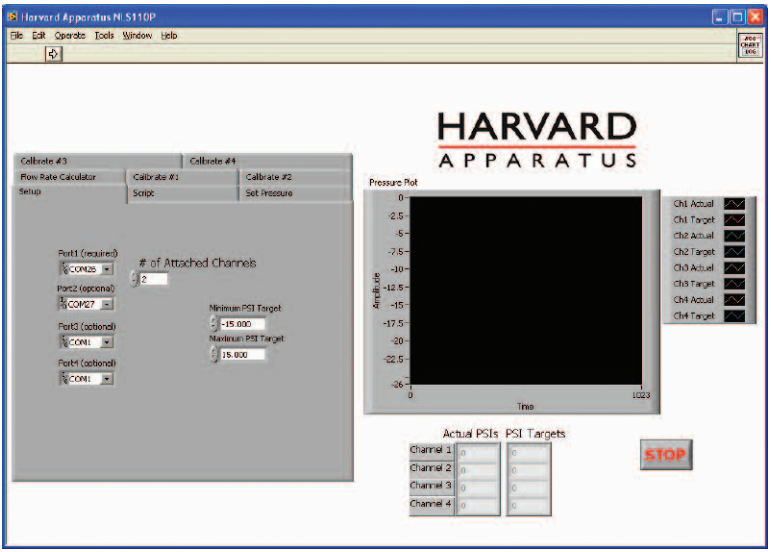

Found New Hardware Wizard
Please wait while the wizard installs the software...
Communications Port
Setting a system restore point and backing up old files in case your system needs to be restored in the future.
< Back
Next >
Cancel

23. When its done click finish

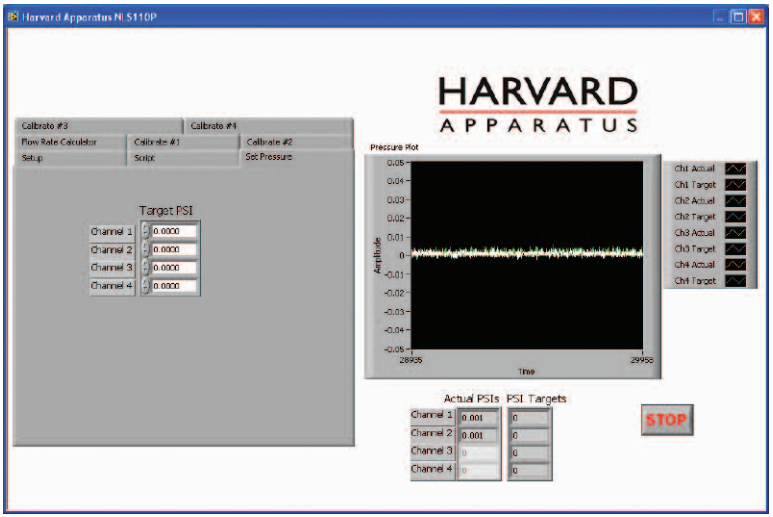


24. Repeat the found hardware installation for the second pump-head
25. Open **USBAPP.EXE**, which can be found in the main folder or by navigating through the CD
26. Click on **Application .exe**
27. The application window should appear
28. On the application.exe click on the dropdown box of port1 (required)
29. You should see a list of com ports, two of these com ports should have consecutive numbers
30. Select the lower numbered com port (between the two consecutive ports)
31. Click on the dropdown box of port2 (optional)
32. Select the higher numbered com port (between the two consecutive ports)
33. Change # of attached channels to 2 (Only if you are using both pump heads)

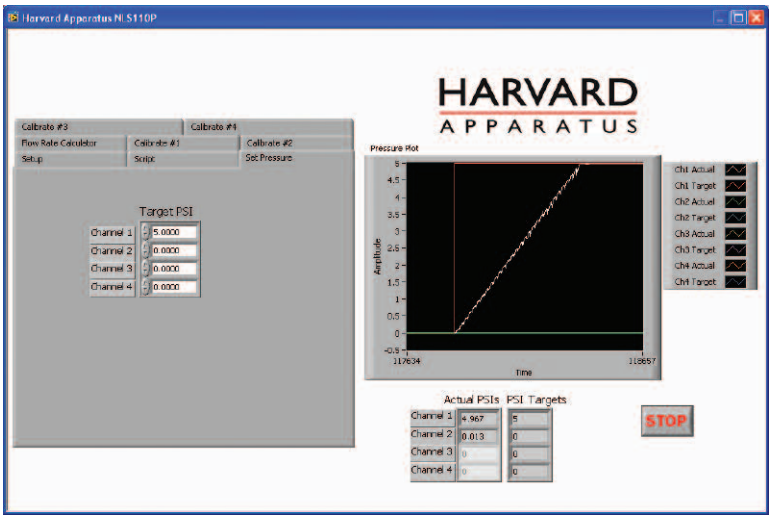
1. Click the RUN arrow on the top left of the screen (underneath "Edit")



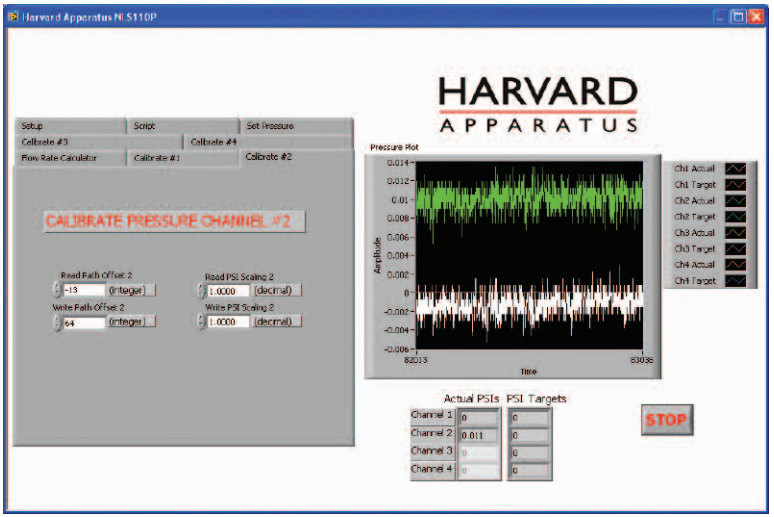
2. The graph on the right should show lines on the 0 amplitude after a few seconds



3. Select Set Pressure tab (If calibration is needed, skip to step 5 first)
4. On the PSI target choose the desired pressure for each channel

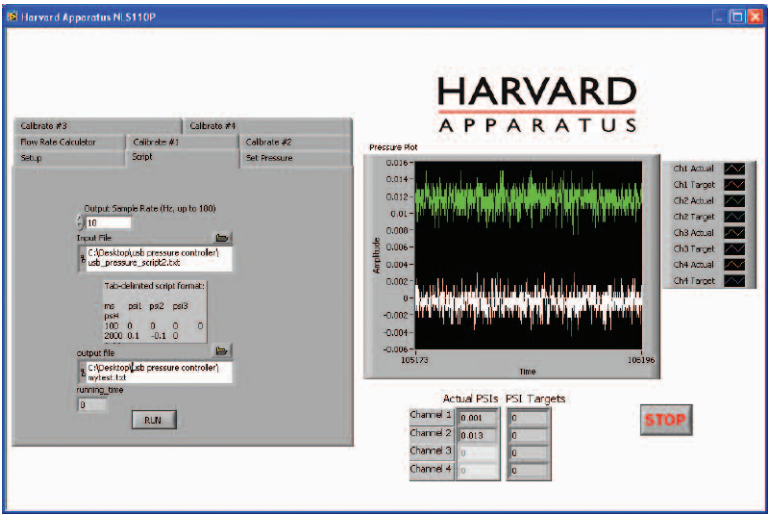


5. Calibration: for each pump head choose the appropriate calibration (ex. Calibration #1) tab and enter in the calibration values provided. The calibration values can be found on the back of the pump directly behind the corresponding pump head*. Each pump head may be recalibrated with the use of a manometer by following the "Calibration Instructions" document on the CD.



** See label on rear panel for calibration values for each pressure head.*

6. Script Files: Under the "Script" tab you can choose to read a script file, select a destination for the output text file, and set a sampling rate. An example of a script file and its corresponding output is provided on the CD



7. Flow Rate Calculator: The flow rate calculator provided in the application is designed to give you an approximation of your current flow rate. By entering in the inner diameter of your tubing, the length of your tubing, and the viscosity of your fluid, the resistance calculator will calculate your resistance. Then, after selecting what is at each end of your tubing, you can enter in the resistance calculated into the "Hydraulic Resistance" field. This will calculate your approximate flow rate.